



**BITS Pilani**  
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# CS/IS F214 Logic in Computer Science

## MODULE: PREDICATE LOGIC

### Prolog Programming

## Example [1]: Relations

### Program:

father('Adam', 'Abel').

mother('Eve', 'Abel').

father('Adam', 'Kane').

mother('Eve', 'Kane').

### Queries:

father(X, 'Abel')?    Ans: X = 'Adam'

father(X, 'Adam')?    Ans: Not Known

mother('Eve', Y)?    Ans: Y = 'Abel' ; Y = 'Kane'

mother(X, Y)?    Ans: X='Eve' and Y='Abel' ; X='Eve' and Y = 'Kane'

### Implicit Control:

Search – which clause (mother, father ...)?

Matching – which term ('Adam', 'Abel' ...)?

## Example [2]: Relational Connectives

### Program:

father('Adam', 'Abel').

mother('Eve', 'Abel').

father('Adam', 'Kane').

mother('Eve', 'Kane').

father('Abel', 'David').

parent(X, Y)  $\leftarrow$  father(X, Y).

parent(X, Y)  $\leftarrow$  mother(X, Y).

grandparent(X, Y)  $\leftarrow$  parent(X, Z),  
parent(Z, Y).

### Queries:

parent(X, 'Abel')?    Ans: X = 'Adam'; X = 'Eve'

grandparent(X, 'David')?    Ans: X = 'Adam'; X = 'Eve'

### Implicit Control (in addition to search and match):

(Non-deterministic) Choice— parent to mother/father:

Matching is done FIFO order in Prolog.

Quantification – existence of Z in grandparent clause?

Example [3]:

Program:

append([], Xs, Xs).

append([Y|Ys], Xs, [Y|Zs]) ← append(Ys,Xs,Zs).

Queries:

append([1,2,3],[4,5,6],Ls)

Ans: Ls = [1,2,3,4,5,6]

append([1,2,3],Ls,[1,2,3,4,5,6])

Ans: Ls = [4,5,6]

append(Ls1,Ls2,[1,2,3,4,5,6])

Ans: Ls1 = [1,2,3] and Ls2 = [4,5,6]

Implicit Control :

Backtracking

1. `last(Ls, X) :- append(Xs,[X],Ls).`
2. `prefix(Xs, Ys) :- append(Xs, Zs, Ys).`  
Alternatively, `prefix(Xs,Ys):-append(Xs,_,Ys).`
3. `substring(Xs, Ys) :- append(_, Xs, Zs),  
append(Zs, _, Ys).`
4. `isWW(WW):- append(W,W,WW).`

## Features:

- Recursive definition of Rules.

  - Search: (say) depth first strategy, with chronological backtracking

- Complex matching of query (arguments) and program parameters:

  - Term unification.

Unification is defined as Tree unification